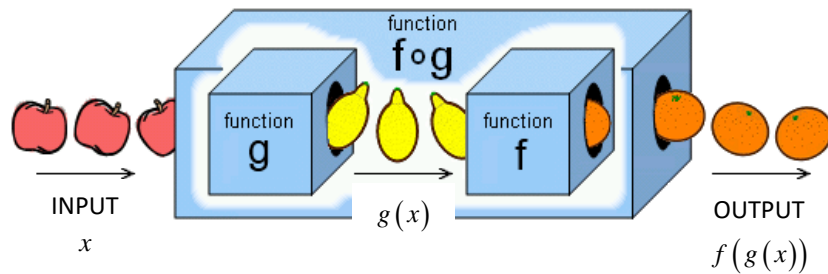


## 5.1 Composite Functions

**Composite Function:** In a composite function, one function is performed, and then a second function is performed on the result of the first function.  $(f \circ g)(x) = f(g(x))$  and  $(g \circ f)(x) = g(f(x))$ .



### Hints:

- Work inside out. Plug the input into the inside function, then plug the result into the outside function.
- $(f \circ g)(x) = f(g(x))$  is not the same as  $(f \cdot g)(x) = f(x) \cdot g(x)$ .

↑  
Composition of functions

↑  
Multiplication of functions

**Example:** Evaluate each expression using the values given in the table.

<b>x</b>	-3	-2	-1	0	1	2	3
<b>f(x)</b>	-7	-5	-3	-1	3	5	7
<b>g(x)</b>	8	3	0	-1	0	3	8

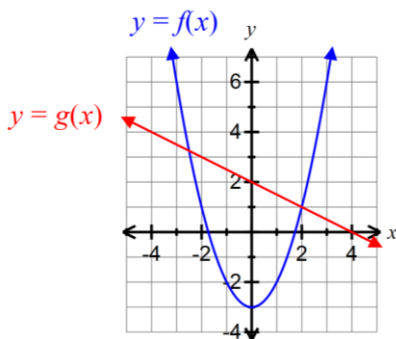
a)  $(f \circ g)(-2)$

b)  $(g \circ f)(-1)$

c)  $(f \circ f)(1)$

d)  $(g \circ g)(0)$

**Example:** Evaluate each expression using the graph.



a)  $(f \circ g)(4)$

b)  $(g \circ f)(-1)$

c)  $(f \circ f)(1)$

d)  $(g \circ g)(0)$

**Example:**  $f(x) = 2x^2$  and  $g(x) = 1 - 3x^2$

a) Find  $(f \circ g)(4)$

b) Find  $(g \circ f)(2)$

c) Find  $(f \circ f)(1)$

d) Find  $(g \circ g)(0)$

### Domain of a Composite Function

The domain of  $f \circ g$  is the set of all numbers  $x$  in the domain of  $g$  such that  $g(x)$  is in the domain of  $f$ .

**Example:** Find the domain of the composite function  $f \circ g$ .

a)  $f(x) = \frac{5}{x+4}, g(x) = \frac{8}{x}$

b)  $f(x) = \frac{x}{x-1}, g(x) = \frac{x+5}{x-4}$

**Example:**  $f(x) = x+1$  and  $g(x) = x^2 + 4$

a) Find  $(f \circ g)(x)$  and its domain.

b) Find  $(g \circ f)(x)$  and its domain.

**Example:**  $f(x) = \frac{1}{x+3}$  and  $g(x) = -\frac{2}{x}$

a) Find  $(f \circ g)(x)$  and its domain.

b) Find  $(g \circ f)(x)$  and its domain.

c) Find  $(f \circ f)(x)$  and its domain.

d) Find  $(g \circ g)(x)$  and its domain.

**Example:** Show that  $(f \circ g)(x) = (g \circ f)(x) = x$ .

a)  $f(x) = 4x$ ;  $g(x) = x/4$

b)  $f(x) = 4 - 3x$ ;  $g(x) = \frac{1}{3}(4 - x)$

**Example:** Find functions  $f$  and  $g$  such that  $f \circ g = H$ .

a)  $H(x) = (x^2 + 1)^4$

b)  $H(x) = |2x + 1|$